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<p>(54) Title: ASSEMBLY FOR A PAPER WEB COATING LINE</p>			
<p>(57) Abstract</p> <p>The method comprises threading the tail of a paper web (1) to be coated through a coating line during startup or web break, in which method an edge strip is slit from the web to act as the tail of the web which is first threaded through the line and then widened to the normal width of the web by moving the edge strip slitter. Said edge strip is first guided to a movable support element (12) located after the edge strip slitting point in the travel direction of the web (1) and the strip is supported against said movable support element (12) and is passed supported by said movable support element (12) to the next support element (14). A guiding/auxiliary support element (31) is brought to the discontinuity points of web support path and the edge strip is passed with the help of said auxiliary support element over the discontinuity and the edge strip is passed through the entire coating line supported by said sequential support elements (2, 12, 14, 18, 19, 22, 25) and said guiding/auxiliary support elements (31).</p>			

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Assembly for a paper web coating line

5 The present invention is related to an assembly according to the preamble of claim 1 for guiding a paper web in a coating line.

10 The invention also concerns a method according to the preamble of claim 12 for threading the web tail through a coating line or coater section.

15 In modern paper finishing lines the web conventionally is passed under the guidance of different kinds of rolls through coater stations and dryer sections. At a web break or startup of the equipment, a narrow edge strip is slit from the web and then the strip is blown into a nip formed by ropes running beside the web, whereby the strip will be threaded through the coating line in the rope carrier nip. During running, the web is subjected to a high stress particularly at a coater station where the 20 situation is further complicated by the increasing moisture content of the web. As a thin base web caliper is today preferred and the goal is to increase the use of recycle fiber as the paper raw material, the web is sensitive to high stress loads. The low strength of the 25 web easily results in web breaks, whereby the situation is termed as critical runnability of the base web. The fragility of the web requires extremely good control of web tension and speed differentials, whereby the implementation of the control and adjustment system of the paper machine section becomes complicated and the 30 running of the equipment requires careful operation to achieve top efficiency.

35 As the fastest paper machines designed for coated grades are run in the production of light-weight printing grades obviously having a low-weight base web, the risk of web breaks is highest particularly in fast machines where web

breaks obviously have greatest impact on profitability. Today, the fastest paper machines are run at web speeds of 1200 - 1500 m/min. Then, the on-machine coating line must cope with the web speed of the paper machine, and 5 additionally, the coating line must provide a reliability figure of at least the same order as that of the paper machine. In an off-line machine, the web speed must be 10 - 15 % higher than the maximum speed of the paper machine to prevent the coating line from forming the bottleneck 10 at the mill. As the base paper sheet may have a basis weight as small as 35 - 55 g/m², running the moist web exiting the coater without web breaks becomes extremely difficult at these speeds.

15 During a web break the web tail must always be threaded through the entire paper machine section, and only after a successful tail threading, the web can be extended to normal width. Tail threading occurs in such a manner that a narrow edge strip called the tail is slit from the web 20 edge and guided by means of air jets into a nip formed by ropes running beside the web serving to thread the web tail through the line, after which the web is extended to full running width by moving the edge strip slitter across the web. Guiding the edge strip into the rope nip 25 is extremely difficult as the tail is subjected to a very high resistance by still-standing air at these machine speeds. Because the edge strip in practice has no stiffness, controlling it into the nip against the resistance of ambient air is cumbersome and required 30 accurate support by means the guiding air jets. The standard practice of tail threading at full web speed in contemporary machines occurs by blowing the edge strip into the rope nip and repeating the tail threading operation as many times as is required to successfully 35 complete the blowing step into the rope nip and the tail threading step. As up to several tens of such attempts may be needed for each web break, it is obvious that

during a web break substantial amounts of broke must be returned to the pulper and the duration of the web break is prolonged, whereby both of these shortcomings essentially reduce the operating efficiency of the line.

5 Naturally, the advantage offered by a higher machine speed remains smaller than expected if the number of web breaks is high and the duration of the breaks is long.

10 On the basis of the above-discussed it is evident that contemporary threading arrangements cannot be used any more if the machine speed is essentially elevated from current speeds, that is, to the very-high-speed range. The lower limit for the very-high-speed range is taken as 1800 m/min, while the design target is set as high as 15 2500 m/min. Obviously, the moist web exiting from a coater cannot be run in current machines at such high speeds in any case. As the air resistance increases proportional to the second power of speed, the conventional method of tail threading will neither be 20 possible in practice. To achieve high efficiency at the high-speed range, the number of web breaks should be kept to the minimum. Also the tail threading step should go essentially smoother than today in order to keep web break downtimes and the amount of broke at a reasonable 25 level. A rapidly moving web invokes an air flow travelling along with the web surface resulting in the entry of the air flow between the guide and pull roll, whereby disturbance and quality impairment will occur at the coater if the air is allowed to gain access between the backing roll and the web or to the application zone. 30 Such problems are heavily accentuated with higher web speeds and concomitant increase of air resistance. The air flow induces oscillation of the web and thus increases the risk of web breaks.

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As the strength of the web against stress is weakest immediately after the coat application step when the

moisture content of the web has increased, attempts have been made to reduce the stresses imposed on the web by means of noncontacting web guidance. In this arrangement the web is passed between air jet cushions blown against the web from the opposite sides of the web, and the travelling direction of the web is altered by means of deflectors adapted to blow an air cushion between the web and the deflector. However, such a noncontacting arrangement is presently still hampered by several drawbacks. Namely, the web tension in this arrangement must anyhow be controlled by the speed differentials of the pull rolls. Consequently, web tension control and smoothing of web tension variations remains as critical and clumsy as in roll-guided arrangements. In fact, variations in web tension form the main reason for web breaks. Implementation of tail threading in the air-jet guided arrangements is also difficult and the control of the web travel in the high-speed range would require an air-jet system of extreme precision. Such a web support system is therefore not a viable solution to the problems of web travel control or tail threading in high-speed paper machine applications.

It is an object of the present invention to achieve such an assembly in which the number of web breaks can be essentially reduced particularly in the high-speed range with a simultaneous improvement of the tail threading step.

The invention is based on passing the web through the entire coating line up to the winder essentially supported by a wire or similar belt-like element.

More specifically, the assembly according to the invention is characterized by what is stated in the characterizing part of claim 1.

Furthermore, the method according to the invention is characterized by what is stated in the characterizing part of claim 12.

5 The invention offers significant benefits.

By virtue of supporting the web along its travel through the entire length of the paper machine section with the help of a wire, the number of web breaks can be essentially reduced. In a wire-supported web the transient speed variations causing changes in web tension are transmitted to the web-supporting wire, whereby variations of web tension causing web breaks in conventional arrangements are eliminated, thus removing this origin of web breaks. As the web travels continuously supported, its vibrations are damped which further lowers the hazard of web breaks. The amount of air travelling along with the web is drastically reduced as the travelling air film can form on one side of the web only. The amount of air travelling along with the web on its other side is reduced by air jets impinging on the web in the air-jet dryer units and suction boxes with their suction slots facing the wire. Each side of the web travels only for a short length in the open air, thus preventing the occurrence of a high-speed air film travelling along with the web surface. This property contributes essentially to the supporting and coating of the web.

At a web break, the wires move the web resting thereon forward in the paper machine section thus facilitating easy removal of the broke to the pulper at any suitable point. Hence, the coating line can be made self-clearing, whereby the downtime due to web break is essentially shortened and the hazardous broke clearing step can be eliminated. The tail threading step becomes easy to implement as the edge strip can be transported through the entire paper machine section supported by the wires,

whereby the wires provide continuous support to the web and the edge strip has no chance of breaking or deflecting sideways. Further, the edge strip need not be fed into a separate rope carrier nip or other transport arrangement, which would be almost impossible operation in the high-speed range. As the edge strip travels in the paper machine section during the tail threading step in the same manner as the web proper under normal operation, the tail threading step will occur safely even in the high-speed range, and no speed reduction is necessary during tail threading. This brings about an essential improvement in the operating efficiency of the apparatus.

In the following, the invention will be examined in more detail with reference to the attached drawings, in which:

Figure 1 is a diagrammatic side view of a coating line implemented using the assembly according to the invention;

Figure 2 is an enlarged side view of the first coater unit of the coating line shown in Fig. 1 with the dryers;

Figure 3 is an enlarged side view of the second coater unit of the coating line shown in Fig. 1 with the dryers;

Figure 4 is a side view of exit end calender and winder of the coating line shown in Fig. 1; and

Figure 5 is a side view of an apparatus suited for guiding the edge strip of the web at a discontinuity point of the wire support assembly.

In the following text, the term wire denotes any woven, air-permeable support element and the term belt denotes any non-air-permeable, flat support element. These terms

are used only for reasons of clarity and must not be understood to limit either of the support elements to any specific technical embodiment.

5 With reference to Figs. 1 - 4, a layout of a coating line is illustrated suitable for an advantageous implementation by means of the assembly according to the invention. This layout comprises an on-machine coating line in which the paper web 1 is passed to the coating line directly from the paper machine with the help of a delivering wire 2. The delivering wire 2 is driven and guided by means of rolls 3. The layout of the line comprises two coater stations 5, 6 with their dryers, a calender 7 and a winder 8. In this coating line layout a 10 single coat is applied to both sides of the web and the 15 coated web is calendered and finally wound into a roll.

The different parts of the machine layout and the parts 20 therein comprising the assembly according to the invention are illustrated in the enlarged views of Figs. 2 - 4. With reference to Fig. 2, the first coater station 25 is shown. The coater station comprises a coater unit 9, an air dryer 13 used for predrying of the web and a dryer cylinder group 15, 16 used for afterdrying. The coater unit 9 includes an endless belt 11 adapted to pass over a backing roll 10 of the coater unit, past the application zone of the coater unit 9 and the backing roll 10. The belt 11 is guided by guide rolls 3. Coating in this kind 30 of apparatus takes place against the belt 11. Also the predryer unit of the dryer section includes a support wire 12 formed into an endless loop by means of guide rolls 3. Two spreader roll units 4 are arranged pressing against the support wire 12. To the proximity of the support wire 12 is placed air dryer units 13 blowing 35 drying air against the wire 13 and the web 1 running thereon.

After the predryer unit is adapted an afterdryer unit which in the illustrated layout comprises suction rolls 15 and heated steam rolls 16. Over the rolls 15, 16 is arranged to pass a support wire 14 adapted to run as an endless loop about guide rolls 3. Between the dryer cylinder group 15, 16 and the predryer unit is placed a receiving roll 17 about which the support wire 14 is also adapted to pass. After the cylinder group 15, 16 is adapted a spreader roll unit 4 pressing against the wire.

To achieve smooth passing of the edge strip over the discontinuity points of web support arrangement as the edge strip jumps from one wire to the next, the discontinuity point can be provided with a guidance device 31, e.g., such as one shown in Fig. 5. This device is comprised of three rolls 29 adapted in a triangle and guide band 30. Two of the rolls 29 form together with the band 30 a support surface which extends from the edge strip delivering roll 3 to the receiving roll 17. When the guidance device is placed at the discontinuity point of the support arrangement, it provides support for the edge strip during the tail threading operation. While the guidance device could be placed permanently to the discontinuity point, in practice it is made transferrable, whereby the guide belt 30 is moved to the discontinuity point only for the duration of the tail threading operation. One of the rolls in the guidance device can be a pull roll, or alternatively, the guide belt 30 can be adapted to press against the support wires 12, 14 so as to make them drive the guide belt directly. The guidance device can further be provided with suction/blowing arrangements to assure the stay of the edge strip on the guide belt.

The function of the coating step and the travel of the web in the coater station of the above-described layout is as follows:

Carried on the delivering wire 2, the web 1 to be coated enters onto the support belt 11 of the coater unit 9. The delivering wire 2 presses that side of the web not facing the wire 2 against the support belt 11, and the web 1 is transferred to travel on support belt 11. Thus, the web 1 is provided with support also at the discontinuity of its path from one support element to another. Running on the support belt 11, the web 1 passes over the backing roll 10 of the coater unit 9 to the application zone, where the exposed side of the web 1 not facing the support belt 11 is coated and smoothed using a suitable amount of coating mix. After coating, the web 1 is passed onto the support wire 12 of the predryer section. As one side of the web 1 is now moist, the web 1 must enter onto the support wire 12 so that the moist side of the web 1 will not be facing the support wire 12. Hence, a similar contacting transfer from one support element to the next cannot be used as that between the delivering wire 2 and the support belt 11 of the coater unit 9. Accordingly, the web 1 must be transferred unsupportedly from the support belt 11 onto the support wire 12. However, the unsupported travel has been kept to a minimum length, thus avoiding large stresses on the web 1 at this discontinuity.

After coating the web 1 tends to widen, whereby it requires cross-machine tensioning to keep the web 1 adequately supported. The cross-machine tensioning, or spreading, of the web 1 is accomplished by tensioning the support wire 12 with the help of purpose-designed spreader rolls 4. The spreader rolls 4 may comprise, e.g., roll units formed by short rolls aligned in the shape of an arc. Such spreader units are well known in the art. Pressing against the support wire of the predryer of the first coater station 5 are adapted two spreader units 4, which are displaced at distance from each other in the machine direction of the wire. To

achieve spreading of the web 1 by means of the support wire 12, the wire structure must be such that permits sufficient spreading of the wire by means of the spreader units 4 and subsequent contraction of the wire to its 5 initial width during one cycle of its path.

Predrying in this embodiment is accomplished by means of air dryers 13 which press the wire 1 against the support wire 12 and provide drying of the web surface to touch-dry. 10

Subsequent to predrying, the web 1 has a touch-dry surface and it can be passed onto a support wire 14 of the cylinder dryer unit. Also here, web transfer takes 15 place without changing the supported side, whereby the web 1 travels over a short gap unsupportedly. The web 1 being transferred enters onto the support wire 14 of the cylinder dryer unit over a receiving roll 17. Next, the wire 1 and the support wire 14 pass to a first suction roll 15, where the support wire 14 is turned so that the web 1 passes into the nip between the wire 14 and the suction roll 15. From the suction roll 15 the web 1 and the wire 14 pass onto a heated steam roll 16, where the web 1 wraps outermost about the roll 16. The heat 20 imparted by the steam roll 16 further removes more water from the web 1. After the web 1 has passed the entire cylinder dryer unit, it is dry and is taken to the next coater station 6 for coating the other side of the web 1. Prior to the transfer of the web 1 onto the next support 25 element, both the web and the wire are once again spread by means of a spreader unit 4.

Web transfer onto the support belt 18 of the second coater station 6 occurs in the same manner as the web transfer from the delivering wire 2 to the support belt 11 of the first coater station. The coater unit 9 of the 30 second coater station and the path of the support belt 18

are arranged in the same manner as in the first coater station. By contrast, the predryer unit and its support wire 19 have a different arrangement. The transfer of the web 1 takes place as described above without a change of 5 the supported side of the web 1. In the travel direction of the web 1, immediately after the web 1 leaves the support belt 18 of the coater unit, is adapted a first air-jet dryer 20 which presses the web 1 against the support wire 19. To the opposite side of the support wire 10 19 is placed a spreader unit 4. From the first dryer 20 the web 1 and the wire 19 pass onto a large-diameter turning roll 21 on which the direction of the web 1 and the wire 19 is turned. Following the turning roll 20 is placed a second spreader unit 4 and a web guide roll 24. 15 After the predrying unit the support wire 19 tangentially passes over the web guide roll 24 and the web is transferred on the guide roll 24 onto a support wire 22 of the second dryer cylinder group 15, 16 as the support wire tangentially meets the guide roll 24. In this manner 20 the web 1 can be transferred from one wire to the next continuously supported without the need for a change of the supported side of the web. A precondition to such an arrangement of web transfer from one wire to the next is that the coat is dried in the dryer 20 to touch-dry 25 before the coated surface of the web is turned against the turning roll 21 or the web guide roll.

The support wire 22 of the dryer cylinder group transfers 30 the web past a second air dryer 23 which completes the predrying, after which the web 1 is passed to the dryer cylinder group 15, 16. From the dryer cylinder group the web 1 is passed to a calender 7. From the calender the web is passed onto a support wire 25 of a winder 8 where 35 the web is transferred on the wire to a roll 26 being wound in the winder. The winder 8 is designed for continuous operation and roll change occurs by bringing an empty core shaft 27 from a storage position close to

the support wire 25 and then striking in the shaft against the web 1. The web 26 being wound onto a full roll 26 is cut and the web 1 is guided to wind about the empty core shaft 27 which is then transferred to the 5 winder station from which the full roll 26 has been removed.

Different requirements are set for the support elements used in the assembly. The support wires must have a 10 spreading capacity to provide under the effect of the spreading rolls sufficient compensation against the spreading of the web and yet be capable of acquiring their initial width during one cycle of wire travel. Furthermore, the wires must have high air penetration to 15 permit removal of water also through the wire and adherence of the web to the wire by means of a vacuum applied to the wire. Such web adherence to the wire is extremely important, and it is assured with the help of compressed-air jets impinging on the web, suction rolls and suction boxes 28 placed behind the support wires. In 20 Fig. 2 the suction boxes are shown only diagrammatically as their construction is well known in the art thus obviating their detailed description herein. Besides and instead of air-jet-based support arrangements, mechanical 25 support means can be used.

The support belts used in the coaters must have a very smooth surface to keep the coat profile impeccably level. Hence, the support belt material must have a smooth 30 surface or maximally containing small-diameter micropores. While adherence to such a belt cannot be arranged by a vacuum, additional support can be provided where necessary by air-jets, and prior to coat application, also mechanically. However, in practice the web being coated tends to adhere relatively strongly to 35 the surface of the smooth support belt by static electricity, and after coat application, adhesion caused

by the moisture of the web, whereby additional support is not necessarily needed.

At a web break the web is cut in a conventional manner and the web is guided to the pulper at a suitable point along the line. By their continuous running, the support belts and wires automatically clear the line free from broke, and after the disturbance is rectified, a new tail threading can be made. When the tail threading is commenced, an edge strip is cut from the web and controlled by means of, e.g., an air jet to the wire, on which it will be adhered by virtue of a vacuum or blown air. At the discontinuity points of the web path such as the ends of the support belts of the coaters and the support wires of the predryers are brought auxiliary support belt devices which guide the edge strip over a discontinuity to the next support element. The edge strip is transferred forward continuously supported by some support element, whereby its breaking during tail threading is avoided. After the edge strip is successfully threaded through the entire line, the edge strip slitter is moved across the web so as to extend the web to its normal width. Accordingly, the tail threading is accomplished in an extremely reliable manner as the supported edge strip cannot break and is easy to guide even at high web speeds to the wide support element.

The assembly according to the present invention can be adapted to almost any coating line layout. Difficulties are encountered only in two-sided coating of the web in a single coater. The coating method used can be selected among, e.g., different kinds of doctor coating methods, film transfer coating or spray coating methods. The method of drying, calendering and winding may be implemented in a desired manner, and the number of different units in the line can be varied. For instance, the number of coater stations, as well as the calender

nips, may be increased to four. Obviously, calendering can also be omitted.

5 At the discontinuities between the support elements the web may be supported mechanically or by means of air jets, and the same means may also be used for guiding the edge strip during tail threading.

10 While the assembly according to the invention is principally intended for machines running at very high speeds, it can be adapted where desirable to a machine layout running at any speed range. Obviously, the assembly is also suited for use in off-machine layouts.

Claims:

1. An assembly for a paper web coating line, said coating line comprising at least

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- one coater station (9) for coating said web (1), and

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- a dryer section (13, 15, 16) for drying the web (1) coated by means of said coater station,

characterized by an assembly for supporting the web (1) essentially over the entire path of the web in the coating line, said assembly comprising at least

15

- a first belt-like support element (2) for supportedly passing the web (1) to the coater station (9),

20

- a second belt-like support element (11) for receiving the web (1) in the coater station (9) from said first belt-like support element (2) and supportedly transferring the web through the application zone of the coater station (9),

25

- at least one belt-like support element (12, 14) for receiving the web (1) from said second belt-like support element (11) and supportedly transferring the web through the dryer section (13, 15, 16), and

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- elements (13, 15) for supporting the web (1) against the surface of said at least one belt-like support element (2, 12, 14) in order to keep the web (1) adhering to said support element.

35

2. An assembly as defined in claim 1, characterized in that said first support element (2) is adapted to deliver the web (1) to said second support element in a contacting manner, whereby the support of the web (1) is free from any discontinuities.

5 3. An assembly as defined in claim 1, characterized in that said second support element (11) is adapted to deliver the web (1) to said belt-like support element (12) of the dryer section (13) so as to 10 keep the supported side of the web (1) unchanged, whereby a discontinuity is formed in the support of the web (1).

15 4. An assembly as defined in any foregoing claim for a coating line comprising a predryer section including air dryers (13) adapted to blow air impinging on the web (1) and a dryer cylinder group (15, 16),

20 characterized by

25 - a belt-like support element (12) of said predryer section adapted to supportedly transfer the web (1) through said predryer section (13), and

30 - a belt-like support element (14) of said dryer cylinder group (15, 16) adapted to receive the web (1) from said belt-like support element (12) and to supportedly transfer the web through said dryer cylinder group (15, 16).

35 5. An assembly as defined in any foregoing claim, characterized in that the elements (13, 15) supporting the web (1) against said support elements comprise means (13) for blowing air impinging on the web (1) and/or means (15) for supporting the adherence of the

web (1) to said support element with the help of a vacuum.

6. An assembly as defined in claim 4 for a coating line comprising at least two coater stations (5, 6), a calender (7) and a winder (8), characterized by a belt-like support element (25) adapted to receive the web (1) entering from said calender (7) and to supportedly transfer the web to a roll (26) of said winder (8).

7. An assembly as defined in claim 1, characterized in that said first belt-like support element (2) is the wire of a paper machine.

8. An assembly as defined in claim 1, characterized in that said first belt-like support element (2) is the support wire of an unwinder.

9. An assembly as defined in any foregoing claim, characterized by a movable belt-like auxiliary support element adapted to be movable to a support discontinuity of the web (1) between said belt-like support elements (11, 12) in order to provide guidance to an edge strip slit acting as the tail of the web over the support discontinuity during tail threading.

10. An assembly as defined in any of foregoing claims 1 - 8, characterized by means for forming an air jet at a support discontinuity of the web (1) between said belt-like support elements (11, 12) in order to provide guidance to an edge strip slit acting as the tail of the web over the support discontinuity during tail threading.

11. An assembly as defined in any foregoing claim, characterized by at least one conventional

spreader device (4), which device is adapted in conjunction with said at least one belt-like support element (12, 14) located after said coater station (9) in said coating line and is suited for spreading said support element (12, 14) and thereby the web (1) is supported by said support element.

12. A method of threading the tail of a paper web (1) to
be coated through a coating line during startup or web
break, in which method an edge strip is slit from the web
to act as the tail of the web which is then threaded
through the line and then widened to the normal width of
the web by moving the edge strip slitter,

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characterized in that

20 - said edge strip is first guided in the travel direction of the web (1) to a movable support element located after the edge strip slitting point in the travel direction of the web and having a width corresponding to the web width and the strip is supported against said movable support element and is passed supported by said movable support element to the next support element.

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30 - a guiding/auxiliary support element is brought to the discontinuity points of web support path and the edge strip is guided with the help of said guiding/auxiliary support element over the discontinuity point, and

35 - the edge strip is passed through the entire
coating line supported by said sequential
support elements (2, 12, 14, 18, 19, 22, 25)
having a width equal to that of the web and by

said guiding/auxiliary support elements, and after the slitting of the edge strip is widened to the normal width supported by said web support elements (2, 12, 14, 18, 19, 22, 25).

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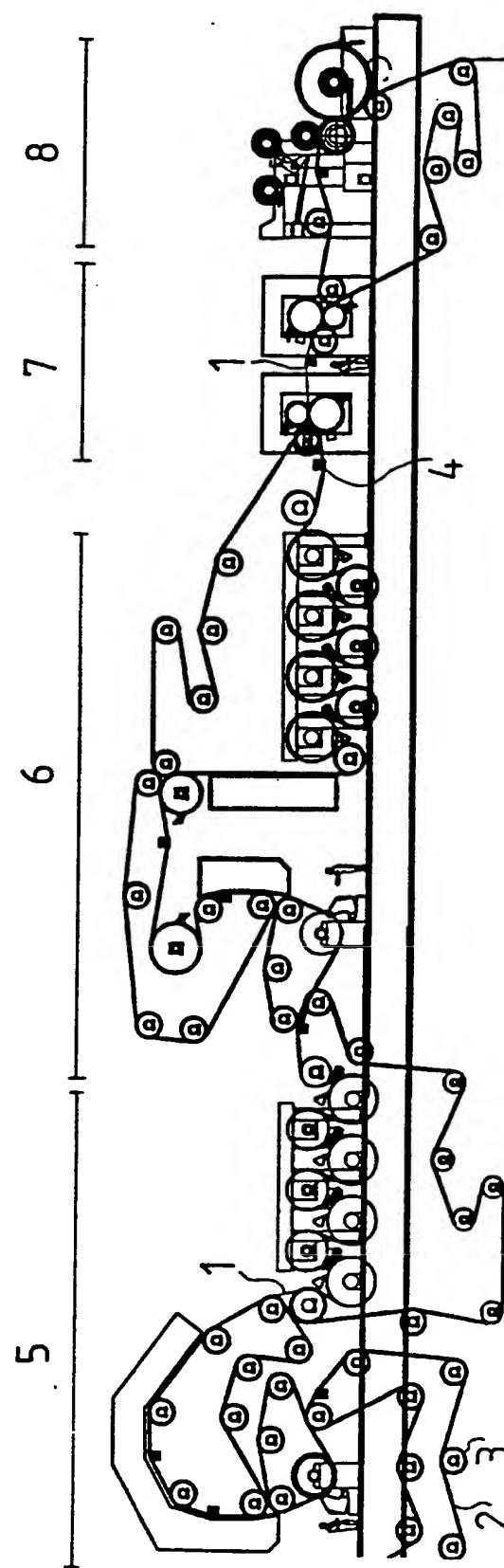
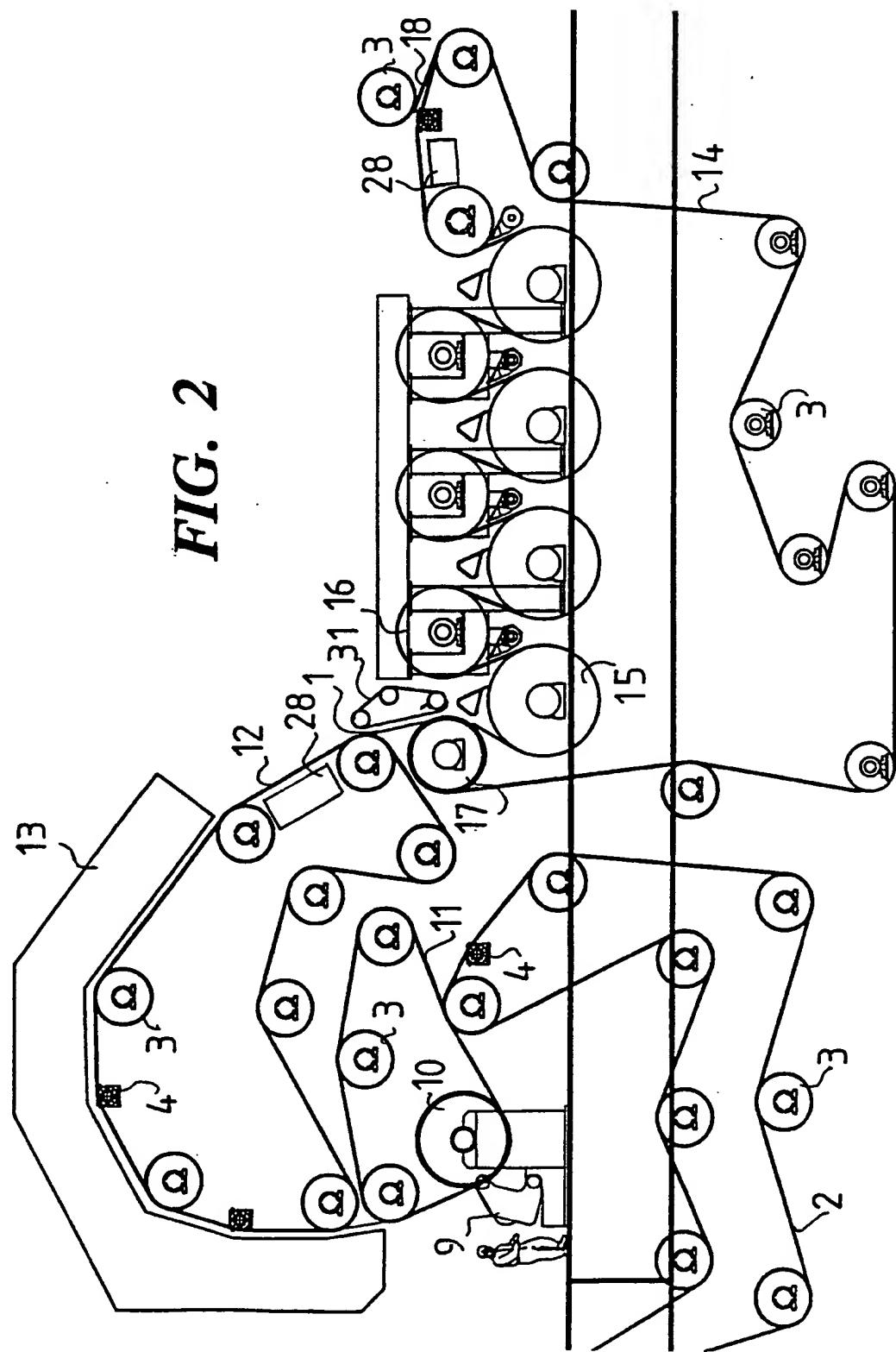


FIG. 1

2/5

FIG. 2



3/5

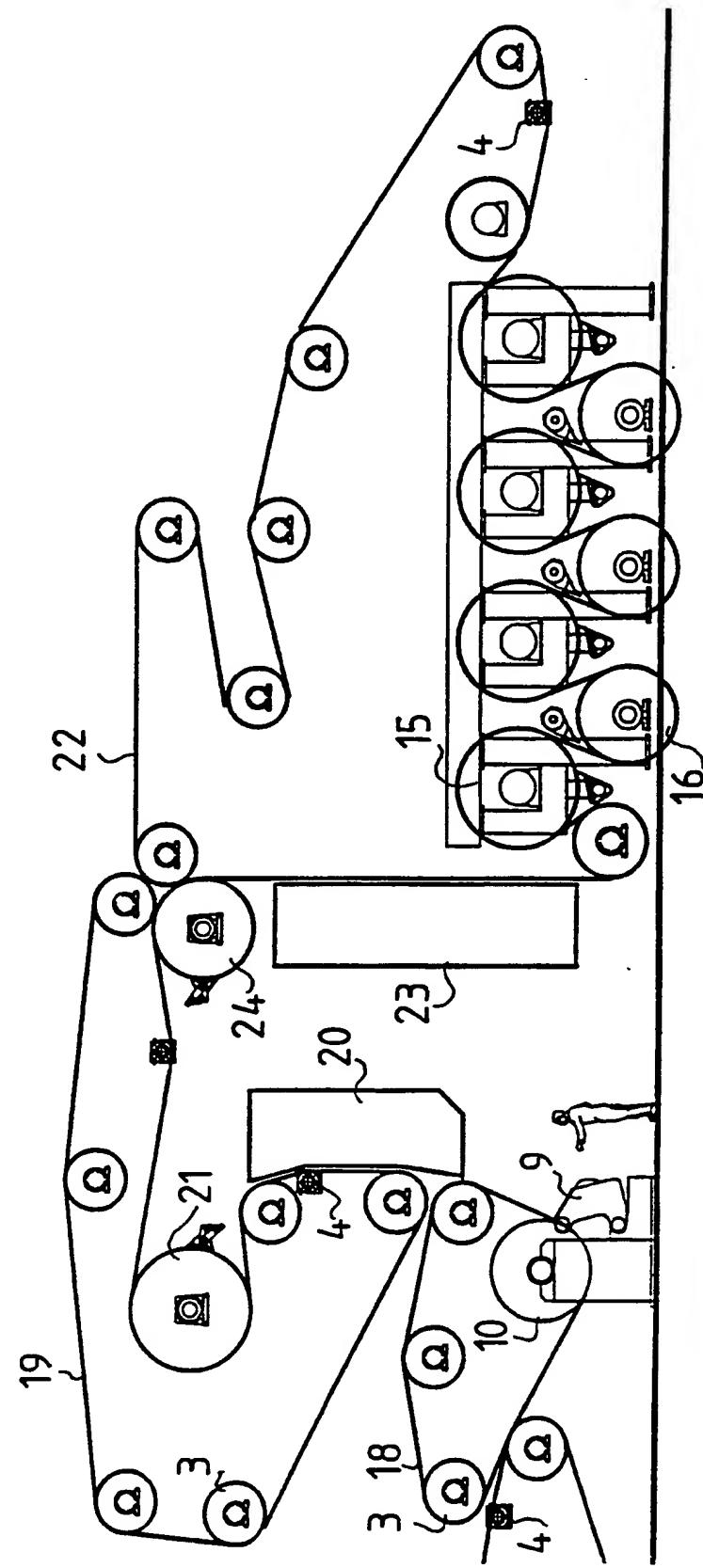


FIG. 3

SUBSTITUTE SHEET

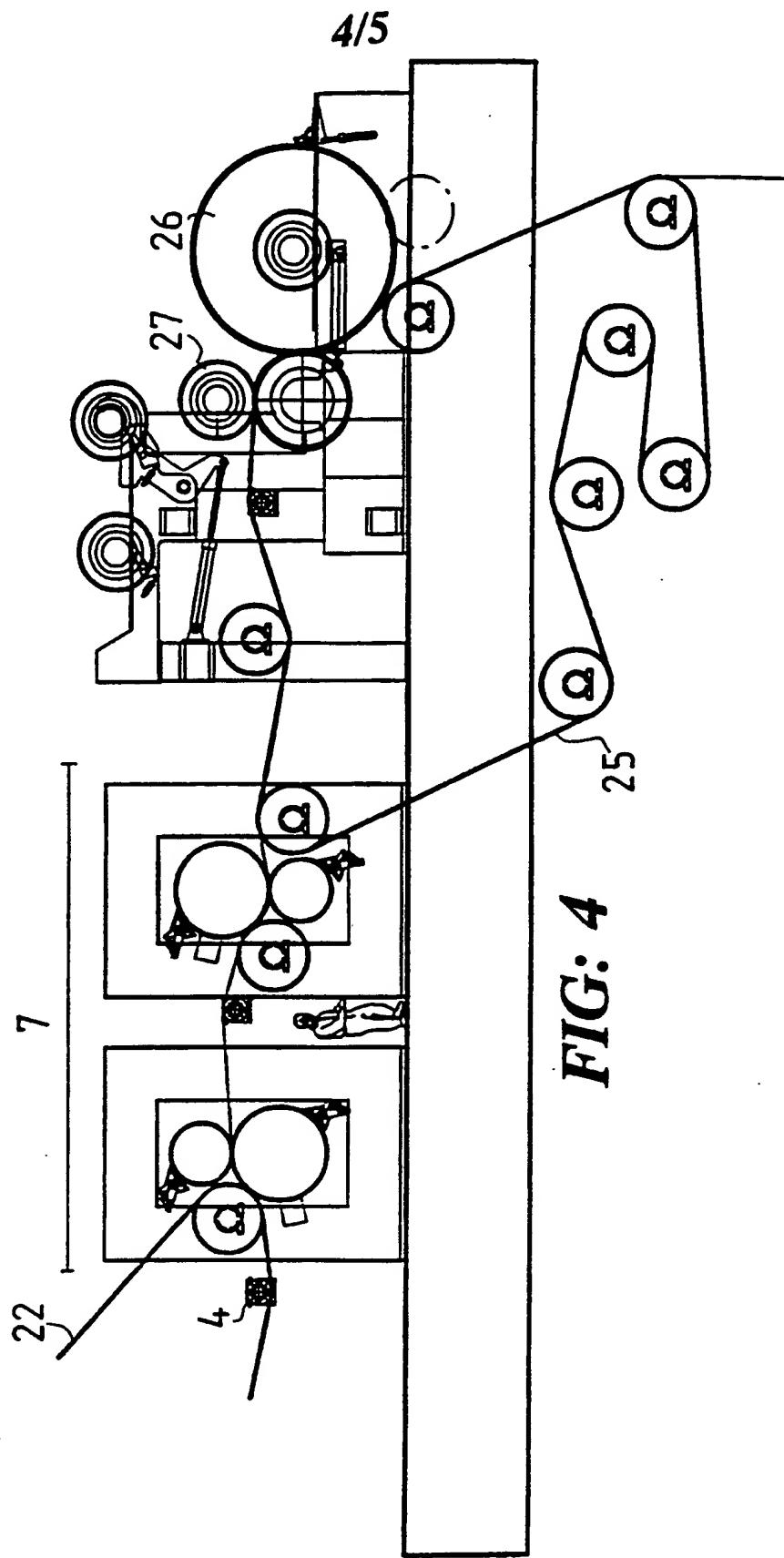
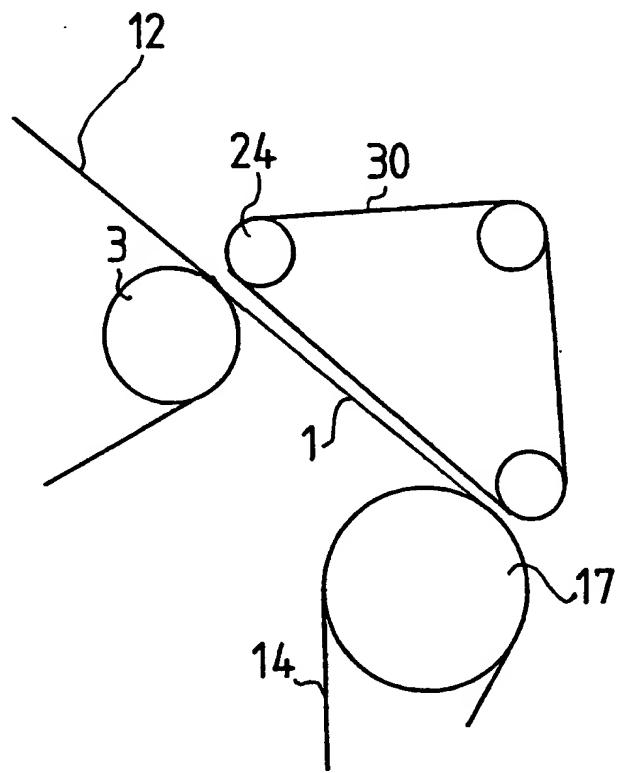


FIG: 4

SUBSTITUTE SHEET

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***FIG. 5***

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 94/00537

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21H 23/70

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21D, D21H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, CLAIMS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP, A1, 0427887 (BELOIT CORPORATION), 22 May 1991 (22.05.91) -----	1-12

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	
A document defining the general state of the art which is not considered to be of particular relevance	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
B earlier document but published on or after the international filing date	*X* document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
L document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*Y* document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
O document referring to an oral disclosure, use, exhibition or other means	*Z* document member of the same patent family
P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search	Date of mailing of the international search report
10 February 1995	06 -03- 1995
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Authorized officer Barbro Nilsson Telephone No. + 46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

31/12/94

International application No.

PCT/FI 94/00537

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP-A1- 0427887	22/05/91	SE-T3- 0427887 CA-A- 2027880 DE-U- 8915851 JP-A- 3161588		17/05/91 10/10/91 11/07/91